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(PCT Rule 61.2)

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Date of mailing (day/month/year) 30 October 2000 (30.10.00)	ETATS-UNIS D'AMERIQUE in its capacity as elected Office
International application No. PCT/US00/02011	Applicant's or agent's file reference 9392-023-228
International filing date (day/month/year) 28 January 2000 (28.01.00)	Priority date (day/month/year) 28 January 1999 (28.01.99)
Applicant KAUFFMAN, Stuart, A. et al	

- ☒ in the demand filed with the International Preliminary Examining Authority on:

21 August 2000 (21.08.00)

- ☐ in a notice effecting later election filed with the International Bureau on:

2. The election ☒ was
☐ was not

made before the expiration of 19 months from the priority date or, where Rule 32 applies, within the time limit under Rule 32.2(b).

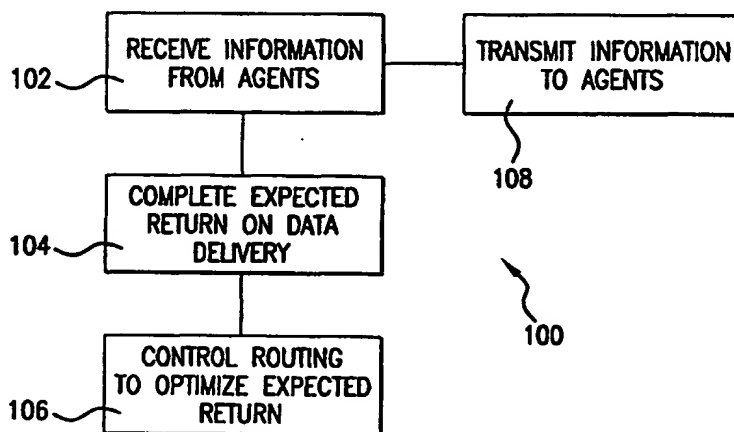
<p>The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland</p> <p>Facsimile No.: (41-22) 740.14.35</p>	<p>Authorized officer</p> <p>Manu Berrod</p> <p>Telephone No.: (41-22) 338.83.38</p>
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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : H04M 15/00, H04L 12/46, G06F 15/18		A2	(11) International Publication Number: WO 00/45584
			(43) International Publication Date: 3 August 2000 (03.08.00)
(21) International Application Number: PCT/US00/02011 (22) International Filing Date: 28 January 2000 (28.01.00) (30) Priority Data: 60/117,663 28 January 1999 (28.01.99) US (71) Applicant (for all designated States except US): BIOS GROUP LP [US/US]; 317 Paseo de Peralta, Santa Fe, NM 87501 (US). (72) Inventors; and (75) Inventors/Applicants (for US only): KAUFFMAN, Stuart, A. [US/US]; 1811 S. Camino Cruz Blanco, Santa Fe, NM 87505 (US). PLATE, Tony, A. [US/US]; 812 Loma Boreal, Santa Fe, NM 87591 (US). (74) Agents: MORRIS, Francis, E. et al.; Pennie & Edmonds LLP, 1155 Avenue of the Americas, New York, NY 10036 (US).		(81) Designated States: AE, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG). Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	

(54) Title: A METHOD AND SYSTEM FOR ROUTING CONTROL IN COMMUNICATION NETWORKS AND FOR SYSTEM CONTROL



(57) Abstract

The present invention relates generally to a method and system for routing control in communication networks and for system control. More particularly, the present invention performs routing by controlling the components in a network with software agents (102) operating in a reward framework using *p*, *tau*, and *patches* (104) to improve communication performance (106). This invention disclosure includes the combination of reinforcement learning agents in a market-based or performance-based reward framework together with optimization techniques called *p*, *tau*, and *patches* (104) as applied to the problem of topology- and load-based routing in data networks, in order to improve communication performance (106) such as communication latency and bandwidth. The invention also applies to the control of other systems, including operations management, job-shop problems, organizational structure, portfolio management, risk management etc.

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EE	Estonia						

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US00/02011

A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) :H04M 15/00; H04L 12/46; G06F 15/18

US CL :Please See Extra Sheet.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 370/252, 253, 255, 270, 400, 408; 706/8, 12, 19, 25; 709/238, 242, 243

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,E --- Y	US 6,046,985 A (ALDRED ET AL) 04 APRIL 2000, col. 4, line 59 to col. 11, line 39.	1, 2, 20, 21, 26, 28 ----- 3-16, 27, 47-48
Y	US 5,790,642 A (TAYLOR ET AL) 04 AUGUST 1998, col. 4, line 11 to col. 9, line 53.	3-16, 27, 47-48
A	AHN ET AL, GENROUTER: A GENETIC ALGORITHM FOR CHANNEL ROUTING PROBLEMS, IEEE, MAY 1995, pp. 151-154.	1-50

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:	*T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
A document defining the general state of the art which is not considered to be of particular relevance	*X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
E earlier document published on or after the international filing date	*Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
L document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	*A* document member of the same patent family
O document referring to an oral disclosure, use, exhibition or other means	
P document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

07 JUNE 2000

Date of mailing of the international search report

06 JUL 2000

Name and mailing address of the ISA/US
Commissioner of Patents and Trademarks
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Washington, D.C. 20231

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Authorized officer

DUONG, FRANK

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Joni Hill

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US00/02011

A. CLASSIFICATION OF SUBJECT MATTER:

US CL :

370/252, 253, 255, 270, 400, 408; 706/8, 12, 19, 25; 709/238, 242, 243

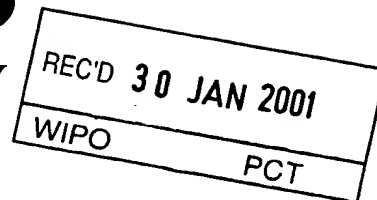
PATENT COOPERATION TREATY

FILE COPY 409

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

Form PCT/IPEA/409 (cover sheet) (July 1998) FILE COPY - DO NOT MAIL



Applicant's or agent's file reference 9392-023-228		FOR FURTHER ACTION See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/US00/02011	International filing date (day/month/year) 28 JANUARY 2000	Priority date (day/month/year) 28 JANUARY 1999	
International Patent Classification (IPC) or national classification and IPC Please See Supplemental Sheet.			
Applicant BIOS GROUP LP			

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 4 sheets.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority. (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 0 sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of report with regard to novelty, inventive step or industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☐ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand 21 AUGUST 2000	Date of completion of this report 15 DECEMBER 2000
Facsimile No. (703) 305-3230	Authorized officer AND Telephone No. DUONG, FRANK (703) 308-5428

INTERNATIONAL PRELIMINARY EXAMINATION REPORT
Form PCT/IPEA/409 (Box I) (July 1998)
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International application No.

PCT/US00/02011

I. Basis of the report

1. With regard to the elements of the international application:*

☒ the international application as originally filed

☒ the description:

pages 1-20 , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

☒ the claims:

pages 21-30 , as originally filed
pages NONE , as amended (together with any statement) under Article 19
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

☒ the drawing:

pages 1-2 , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

☒ the sequence listing part of the description:

pages NONE , as originally filed
pages NONE , filed with the demand
pages NONE , filed with the letter of _____

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.

These elements were available or furnished to this Authority in the following language _____ which is:

☐ the language of a translation furnished for the purposes of international search (under Rule 23.1(b)).

☐ the language of publication of the international application (under Rule 48.3(b)).

☐ the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

☐ contained in the international application in printed form.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority in written form.

☐ furnished subsequently to this Authority in computer readable form.

☐ The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished.

☐ The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished.

4. ☒ The amendments have resulted in the cancellation of:

☒ the description, pages NONE

☒ the claims, Nos. NONE

☒ the drawings, sheets/fig NONE

5. ☐ This report has been drawn as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Form PCT/IPEA/409 (Box V) (July 1998)
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International application No.

PCT/US00/02011

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. statement

Novelty (N)	Claims <u>1-50</u>	YES
	Claims <u>NONE</u>	NO
Inventive Step (IS)	Claims <u>1-50</u>	YES
	Claims <u>NONE</u>	NO
Industrial Applicability (IA)	Claims <u>1-50</u>	YES
	Claims <u>NONE</u>	NO

2. citations and explanations (Rule 70.7)

Claims 1-50 meet novelty under PCT Article 33(2) because the prior art of record, considered individually or in combination, fails to show or suggest a method and system for routing control in communication networks that performs routing by controlling the components in a network with software agents operating in a reward framework, wherein a fitness landscape optimization algorithm is used to improve communication latency and bandwidth in a manner set forth as claimed. Moreover, the cited references of record are relevant to the claimed invention, but fails to establish themselves as the prior art.

Claims 1-50 meet industrial applicability as defined by PCT Article 33(4) since the instant invention is applicable in routing control of a communication network.

----- NEW CITATIONS -----

NONE

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

Form PCT/IPEA/409 (Supplemental Box) (July 1998)
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International application No.

PCT/US00/02011

Supplemental Box

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: Boxes I - VIII

Sheet 10

CLASSIFICATION:

The International Patent Classification (IPC) and/or the National classification are as listed below:

IPC(7): H04M 15/00; H04L 12/46; G06F 15/18 and US Cl.: 370/252, 253, 255, 270, 400, 408; 706/8, 12, 19, 25; 709/238, 242, 243